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**MASKING TAPE**

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MASKING TAPE

[Masukinteepeu]

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[There are no amendments to this patent]

Claim

1. A masking tape, characterized in that a tape base material is coated with an adhesive composition obtained by mixing natural rubber or a modified material thereof as the principal ingredient with a thermally reactive resin forming a network structure, a crosslinking agent of the thermally reactive resin, and a monomer having an acryloyl (methacryloyl) group, dried and irradiated to form an adhesive layer on the tape base material to obtain a masking tape.

2. A masking tape according to Claim 1, wherein 1-50 parts by weight of a monomer having 2 or more acryloyl (methacryloyl) groups are added to 100 parts by weight of the principal ingredient.

3. A masking tape according to Claim 1, wherein the irradiation is carried out by an electron beam at a dose of 0.1-50 Mrad.

#### Detailed explanation of the invention

##### Industrial application field

The present invention relates to a masking tape to be used for automobile coating, etc.

##### Prior art

Masking tapes to be used for a bake finish as represented by automobile coatings, etc. need high heat resistance so that the cohesive force of the adhesive is not lowered by heating and so that the peeling property is not impaired by a notable rise in the adhesion force in addition to good adherence and adhesive solvent resistance for preventing the intrusion of paint.

As conventional adhesives for masking tapes, adhesives obtained by mixing natural rubber or a modified material thereof as the principal ingredient with acrylic rubber and a thermally reactive resin forming a network structure are known, but their heat resistance is not sufficient.

##### Problem to be solved by the invention

The present inventors previously proposed an adhesive obtained by mixing natural rubber or a modified material thereof as the principal ingredient with acrylic rubber, a thermally reactive resin forming a network structure, a crosslinking agent of the thermally a reactive resin and reactive phenolic resin for masking tapes as one satisfying the aforementioned requirement (Japanese Kokai Patent Application No. Hei 1[1989]-27110).

However, the coating mode has been changed from a conventional one coating-one baking mode (so-called 1C1B) to a two coating-one baking mode (so-called 2C1B) for rationalization of production, etc. In addition, the baking time for each baking has been shortened, and the amount of solvent remaining in the coating film has increased. Further, the hardening of coating materials has become insufficient. Therefore, the aforementioned reactive phenolic resin of an adhesive for masking tapes easily bled out by means of remaining solvent so that problems such as adhering to objects, lowering of the cohesive force of the adhesive, the occurrence of adhesion by breaking of cohesion, etc. have arisen.

The objective of the present invention is to solve these problems and to provide masking tapes that have superior solvent resistance.

Means for solving the problem(s)

Namely, the present invention solves the aforementioned problems and provides a masking tape, characterized in that a tape base material is coated with an adhesive composition obtained by mixing natural rubber or a modified material thereof as the principal ingredient with a thermally reactive resin forming a network structure, a crosslinking agent of the thermally reactive resin and a monomer having an acryloyl (methacryloyl) group, dried and irradiated to form an adhesive layer on the tape base material to obtain the masking tape.

Hereinafter, the present invention will be explained in detail.

As tape base materials to be used in the present invention, those, which are commonly used in masking tapes, such as a vinyl chloride film, etc. are used.

As natural rubber used in the adhesive for the masking tape of the present invention, ribbed smoked sheet, air dried sheet, pale crepe, etc. which are commonly used, are examples. Furthermore, modified materials such as Heveaplus MG obtained by grafting methyl methacrylate to natural rubber, SP rubber, etc. can be substituted for natural rubber or used along with natural rubber.

As thermally reactive resins forming a network structure to be used in the present invention, compounds having 2 or more carboxyl groups, amino groups, epoxy groups, etc., which have reactivity with crosslinking agents, are examples. Concretely, polyisoprene resin, polybutadiene resin, polystyrene-butadiene resin, polyester resin, polyurethane resin, etc., which have hydroxyl groups, carboxyl groups, amino groups, epoxy groups, etc. at both ends or at side chains, are examples.

Next, as crosslinking agents of the thermally reactive resin, commonly used thermally reactive crosslinking agents such as polyfunctional isocyanates, amino resins, amines, epoxy resins, etc. are examples. Especially, polyfunctional isocyanates, amino resins, etc., which quickly react at relatively low temperature, are desirable. Here, as polyfunctional isocyanates, those used in general crosslinking, such as tolylene diisocyanate, diphenylmethane diisocyanate, 1,5-naphthalene diisocyanate, hexamethylene diisocyanate, trimethylhexamethylene diisocyanate, triphenylmethane triisocyanate, polyphenylmethane polyisocyanate, etc. or various derivatives such as the trimethylolpropane adduct of tolylene diisocyanate, biuret of hexamethylene diisocyanate, etc., can be utilized.

Amino resins are addition condensation products of melamine, benzoguanamine, and urea with formaldehyde or alcohol, and concretely methylol melamine, methylated methylol melamine, butylated butylol, methylol benzoguanamine, methylol urea, etc. are exemplified.

As particularly preferable thermally reactive resins and crosslinking agents thereof, OH group-containing polybutadiene resins or polyurethane resins or polyisoprene resins and polyfunctional isocyanates or amino resins are exemplified.

In addition, the thermally reactive resin is mixed at an amount of preferably 1-100 parts by weight and further preferably 5-30 parts by weight per 100 parts by weight of natural rubber or a modified material thereof, and the crosslinking agent is mixed approximately in equivalence with respect to the functional group of the thermally reactive resin.

As monomers having an acryloyl (methacryloyl) group to be used in the present invention, monofunctional acrylic acid (methacrylic acid) alkyl esters such as methyl acrylate (methacrylate), butyl acrylate (methacrylate), 2-ethylhexyl acrylate (methacrylate), etc., and polyfunctional monomers having 2 or more acryloyl (methacryloyl) groups such as ethylene glycol diacrylate (methacrylate), diethylene glycol diacrylate (methacrylate), triethylene glycol diacrylate (methacrylate), polyethylene glycol diacrylate (methacrylate), propylene glycol diacrylate (methacrylate), dipropylene glycol diacrylate (methacrylate), polypropylene glycol diacrylate (methacrylate), 1,4-butanediol diacrylate (methacrylate), 1,5-pentadiol diacrylate (methacrylate), 1,6-hexanediol diacrylate (methacrylate), trimethylolmethane triacrylate (methacrylate), trimethylolpropane triacrylate (methacrylate), pentaerythritol triacrylate (methacrylate), tetramethylolmethane tetraacrylate (methacrylate), etc. are exemplified, and those are used singly or as a mixture of several.

The mixing amount is 1-50 parts by weight and preferably 2-20 parts by weight per 100 parts by weight of the main ingredient. If it is less than 1 part by weight, there is no effect for improvement of solvent resistance. If it exceeds 50 parts by weight, the adhesive force decreases and it cannot be used as masking tape.

In the adhesive compositions of the present invention, known tackifiers from natural materials or derivatives thereof such as various rosin type resins, terpene resin, terpene-phenol resin, etc., synthetic resins such as aliphatic, alicyclic or aromatic petroleum resins, phenolic resin or xylene resin, etc. can be used singly or in combination.

Furthermore, petroleum system softening agents such as process oil, extender oil, etc., softening agents of liquid rubber such as polyisobutylene, liquid polyisoprene, etc. or synthetic plasticizer, etc., and various fillers such as calcium carbonate, magnesium carbonate, magnesium oxide, zinc oxide, silicate, silica etc. can be added as needed.

In addition, various oxidation preventing agents such as phenols, phosphates, phenol-phosphates, thioethers, etc., light stabilizers, and aging resistors such as heavy metal inactivating agents, etc. can be added.

This adhesive composition is diluted by a diluent such as an organic solvent if necessary and coated on tape base materials.

Furthermore, the tape base materials are used after coating with a rear treating agent or undercoat if necessary.

Next, drying is a process for evaporation and removal of water or organic solvent used for dilution of adhesives in the production of masking tapes and for advancement of the crosslinking reaction between the thermally reactive resin and the crosslinking agent, and generally a hot air blast type dryer is used. The drying temperature is suitably decided according to the base material and the reaction temperature between the thermally reactive resin and the crosslinking agent, but it is generally 50-160°C and preferably 80-120°C. If it is lower than 50°C, the reaction between the thermally reactive resin and the crosslinking agent does not advance sufficiently while if it exceeds 160°C the base material softens by heat and cannot be transported.

Irradiation is a process for polymerization and crosslinking of monomers having an acryloyl (methacryloyl) group. Here, radiation means active energy beams including ionizing radiation such as  $\alpha$  rays,  $\beta$  rays,  $\gamma$  rays, neutron beam, an accelerated electron beam, etc. and ultraviolet rays. The radiation dose to be used is in the range of 0.5-50 Mrad, and a range of about 1-10 Mrad is desirable. Further, in the case of ultraviolet rays, a high-voltage mercury lamp with a wavelength range of about 180-460 nm is suitable as the generation source.

If the dose is lower than 0.1 Mrad, the reaction for polymerization and crosslinking of monomers having an acryloyl (methacryloyl) group advances insufficiently while if it exceeds 50 Mrad, the adhering force is lowered or the base material is damaged by side reactions and use as a masking tape is difficult.

Furthermore, as radiation, an accelerated electron beam is desirable due to easy management and high energy efficiency.

Attention to the irradiation environment is necessary. In short, since the polymerization of generated radicals is hindered by oxygen in the air, it is preferable to lower the irradiation environment oxygen concentration to a suitable level by using an inert gas such as nitrogen according to circumstances.

#### Operation of the invention

The following may be considered to be the reason that the masking tape of the present invention has high solvent resistance.

The monomer having an acryloyl (methacryloyl) group also forms a network structure in the irradiation process in addition to the network structure formed by the thermally reactive resin and its crosslinking agent in the drying process so that the cohesion force is improved. Furthermore, the active points, such as radicals, formed in the principal ingredient, natural rubber or a modified material thereof, in the irradiation process react with the aforementioned monomer having an acryloyl (methacryloyl) group to carry out direct crosslinking of the principal ingredient so that the solvent resistance is improved.

### Application examples

Hereinafter, the present invention will be explained by application examples, but the present invention is not limited to these.

An adhesive composition shown in Table 1 was coated at 15  $\mu\text{m}$  as a solid on a 100  $\mu\text{m}$ -thick PVC film (Okamoto Co.) containing 32 parts by weight plasticizer, dried by heating at 110°C for 2 minutes, and treated by exposing to an electron beam at an acceleration voltage of 175 KV in various doses under a nitrogen atmosphere (oxygen concentration: 500 ppm) using an electron beam application device (Electrocurtain CB150/15/10, ESI Co.) to obtain a masking tape, and its performance was evaluated. The results are also shown in Table 1. The evaluation methods were as follows.

(1) Initial adhesive force: It was measured in accordance with JIS-C-2107 using an SUS-430BA plate as a coating object.

(2) Change of adhesive force with time and solvent resistance: A sample tape stuck to an SUS-430BA plate was dipped in 1,1,1-trichloroethane for 1 minute and heated at 120°C for 60 minutes, and the change of adhesive force was shown in %. In addition, the peeled surface of the SUS-430BA plate was observed to examine adhesion of the adhesive.

### Explanation of symbols

○: no adhesion,  $\Delta$ : adhered (lightly), x: adhered (notably)

Table 1 \*

		AE1	AE2	CE1	CE2	AE3	CE3	CE4
Mixing (parts by weight)	Graft natural rubber (Heveaplus MC 30)	100	100	100	100			
	Natural rubber (pale crepe)					100	100	100
	Polyurethane (Nippolan 3022) <sup>1)</sup>	10		10	10			
	Polyisoprene (Kuraprene LIR-503) <sup>2)</sup>		10			15	15	15
	Isocyanate (Coronate) <sup>1)</sup>	3	1	3	3	1.5	1.5	1.5
	Catalyst (dibutyltin dilaurate) <sup>3)</sup>	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Tackifier (Piccolyte S-115) <sup>4)</sup>	50	50	50	50	75	75	75
	Oxidation preventing agent (Mark AO-23) <sup>5)</sup>	5	5	5	5	5	5	5
	1,6-hexanediol diacrylate <sup>6)</sup>	5			5			
	Trimethylolpropane triacrylate <sup>7)</sup>		5			10	10	
Electron beam dose (Mrad)		4	4	4	0	4	0	4
Performance	Initial adhesive force (gf/25 mm width)	500	580	650	680	600	750	700
	Change of adhesive force with time (%)	110	125	180	210	130	240	200
	Solvent resistance	○	○	Δ	x	○	Δ	x

1) Nippon Polyurethane Industry Co.

2) Kuraray Co.

3) Wako Pure Chemical Co.

4) Rika Hercules Co.

5) Adeka Argus Chemical Co.

6) Nippon Kayaku K.K.

7) Tokyo Kasei Kogyo Co.

#### Effect of the invention

Masking tapes of the present invention show little change of adhesive force with time to improve the cohesion force so that the solvent resistance is improved to obtain the excellent characteristic of no adhesion of the adhesive.

\* [AE = application example; CE = comparative example]